NASA Glenn Safety Manual

CHAPTER 34 – FALL PROTECTION

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34.1 SCOPE

This chapter describes policies and the minimal safe practices relating to all activities where Fall Protection is required at the NASA Glenn Research Center at Lewis Field and Plum Brook Station (GRC). All personnel performing activities where fall protection is required shall do so in a safe manner. All personnel utilizing fall protection systems shall meet or exceed the minimum safety requirements defined herein, and shall comply with all other Federal, State, and local requirements and standards. Exception: The provisions of this Chapter do not apply when employees are making an inspection, investigation, or assessment of workplace conditions prior to the actual start of the work or after all the work has been completed.

34.2 APPLICABILITY

The provisions, responsibilities, and requirements as set forth in this chapter apply to:

a. All NASA Glenn Research Center at Lewis Field and Plum Brook (GRC) employees.
b. All Glenn contractors, other NASA contractors, non-NASA and non-contractor individuals present at Glenn in accordance with the terms of their contracts or agreements with NASA.
c. Other Government organizational elements that are tenants at Glenn or any other locations under Glenn jurisdiction.

34.3 DEFINITIONS

“anchorage” means a secure point of attachment for a lifeline or lanyard;

“body harness” means straps which may be secured about the employee in a manner that will distribute the fall arrest forces over at least the thighs, pelvis, waist, chest and shoulders with means for attaching it to other components of a personal fall arrest system.

”c*ontrolled access zone” (CAZ)* means an area in which certain work (e.g., overhand bricklaying) may take place without the use of guardrail systems, personal fall arrest systems, or safety net systems and access to the zone is controlled.

“dangerous equipment” means equipment (such galvanizing tanks, degreasing units, machinery, electrical equipment, and other units) which, as a result of form or function, may be hazardous to employees who fall onto or into such equipment.

“equivalent” means alternative designs, materials, or methods to protect against a hazard which the employer can demonstrate will provide an equal or greater degree of safety for employees than the methods, materials or designs specified in the standard.

“*failure”* means load refusal, breakage, or separation of component parts. Load limit is the point where the ultimate strength is exceeded.

“fall arrest system” means a system that will stop a worker's fall before the worker hits the surface below;

“fall protection system” means any of the following when used to protect a worker from a fall or minimize the risk from falling:

a. guardrails;
b. a safety belt or full body harness with a lanyard and/or lifeline and an anchor, and their related equipment;
c. a safety net;

d. a control zone;
e. a safety monitor with a control zone;
f. other procedures acceptable to the GSO;

“*fall restraint system*” means a work positioning system to prevent a worker from falling from a work position, or a travel restriction system such as guardrails or a personal fall protection system to prevent a worker from traveling to an edge from which the worker could fall;

“*free fall distance*” means the distance from the point where the worker would begin to fall to the point where the fall arrest system would begin to cause deceleration of the fall;

“*full body harness*” means a body support device consisting of connected straps designed to distribute a fall arresting force over at least the thigh, shoulders and pelvis, with provision for attaching a lanyard, lifeline or other components;

“*guard*” means a protective barrier around an opening in a floor or along the open sides of stairs or a ramp, landing, balcony, mezzanine, raised walkway or any other area to prevent a fall to a lower level, or inadvertent entry into a dangerous area;

“*guardrail*” means a guard consisting of a top rail 40 in to 44 in (102 cm to 112 cm) above the work surface, and an intermediate rail located approximately midway between the underside of the top rail and the top of the toeboard, if one is provided, or the work surface if no toeboard is provided.

“*hole*” means a gap or void 2 inches (5.1 cm) or more in its least dimension, in a floor, roof, or other walking/working surface.

“*horizontal lifeline system*” means a system composed of a synthetic or wire rope, installed horizontally between 2 anchors, to which a worker attaches a personal fall protection system;

“*lanyard*” means a flexible line of webbing, or synthetic or wire rope, that is used to secure a safety belt or full body harness to a lifeline or anchor;

“*low-slope roof*” means a roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

“*lower levels*” means those areas or surfaces to which an employee can fall. Such areas or surfaces include, but are not limited to, ground levels, floors, platforms, ramps, runways, excavations, pits, tanks, material, water, equipment, structures, or portions thereof.

“*lifeline*” means a synthetic or wire rope, rigged from one or more anchors, to which a worker's lanyard or other part of a personal fall protection system is attached;

”*opening”* means a gap or void 30 inches (76 cm) or more high and 18 inches (48 cm) or more wide, in a wall or partition, through which employees can fall to a lower level.

“overhand bricklaying and related work” means the process of laying bricks and masonry units such that the surface of the wall to be jointed is on the opposite side of the wall from the mason, requiring the mason to lean over the wall to complete the work. Related work includes mason tending and electrical installation incorporated into the brick wall during the overhand bricklaying process.

“personal fall protection system” means an individual worker's fall protection system, composed of a safety belt or full body harness, and lanyard, lifeline, and any other connecting equipment, that is used to secure the worker to an individual anchor or to a horizontal lifeline system;

“personal fall arrest system” means a system to arrest an employee in a fall. It consists of anchorage, connectors, and a body harness. A lanyard, deceleration device, lifeline or combinations of these may be included.

"*qualified*" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve or resolve problems related to the subject matter, the work, or the project.

“roof” means the exterior surface on the top of a building. This does not include floors or formwork which, because a building has not been completed, temporarily becomes the top surface of a building.

“roofing work” means the hoisting, storage, application, and removal of roofing materials and equipment, including related insulation, sheet metal, and vapor barrier work, but not including the construction of the roof deck.

“safety monitor system” means a safety system in which a competent person is responsible for recognizing and warning employees of fall hazards.

”s*teep roof”* means a roof having a slope greater than 4 in 12 (vertical to horizontal).

“unprotected sides and edges” means any side or edge (except at entrances to points of access) of a walking/working surface, e.g., floor, roof, ramp, or runway where there is no wall or guardrail system at least 39 inches (1.0 m) high.

“walking/working surface” means any surface, whether horizontal or vertical on which an employee walks or works, including, but not limited to, floors, roofs, ramps, bridges, runways, formwork and concrete reinforcing steel but not including ladders, vehicles, or trailers, on which employees must be located in order to perform their job duties.

“warning line system” means a barrier erected on a roof to warn employees they are approaching an unprotected roof side or edge, and designates an area in which roofing work may take place without the use of guardrail, body harness, or safety net systems to protect employees in the area.

34.4 RESPONSIBILITIES

All personnel at NASA Glenn Research Center at Lewis Field and Plum Brook Station, who meet the requirements for fall protection, are responsible for understanding this chapter and conforming to its practices and provisions.

34.4.1 Glenn Safety Office

a. The Glenn Safety Office Chief is the designated Authority Having Jurisdiction (AHJ.)
b. The Glenn Safety Office Chief has the overall management responsibility for direction, and execution of a Fall Protection Safety Program for GRC.
c. The GSO provides guidance and direction for center-wide activities that involve fall protection safety.
d. GSO Safety Specialists and Engineers advocate for appropriate fall protection systems and implementation with the Contraction Officer Technical Representative (COTR) for all onsite and construction contractors.

34.4.2 Supervisors

Supervisors shall designate a competent person for each task requiring fall protection. Supervisors of NASA and contractor personnel shall ensure that employees under their supervision who are required to use a fall protection system are trained to recognize the hazards associated with falls from elevated heights, and shall ensure that employees under their supervision comply with the requirements of this chapter and with the applicable fall protection procedures. Supervisors shall also ensure that employees requiring fall protection utilize the necessary fall protection systems in a safe manner and in accordance with the manufacturer’s recommendations for the of the specific fall protection systems. Supervisors shall assure employees have a complete understanding of the rescue plan the procedures in case of an emergency.

34.4.3 Civil Servants Employees

All employees at the NASA Glenn Research Center at the Cleveland facilities and Plum Brook Station are responsible for understanding and conforming to the policies, safe practices, and provisions of this Chapter.

34.4.4 Contractor Employees

All on-site and off site contractor employees shall comply with the provisions in Section 34.4.3 of this Chapter. All contractors shall understand and conform to the policies, safe practices, and provisions of this Chapter.

All on-site and off site contractor employees utilizing fall protection at GRC are responsible for submitting in writing a site-specific Health and Safety Plan (HASP) that identifies:

a. The hazardous conditions requiring fall protection
b. The methods of fall protection that will be used to ensure a safe and healthful working environment.
c. How the contractor plans to protect both the health and safety of NASA and contractor employees and government property and equipment.
d. A written rescue plan to retrieve a fallen or suspended worker from the area.

34.4.5 Competent Person

For the purposes of this Chapter, the competent person shall be qualified in the following areas of fall protection:

a. Natures of fall hazards
b. Erecting, maintaining, disassembling, and inspection of the fall protection systems
c. The use and operations of fall protection systems
d. Handling and storage of equipment and materials and erection of overhead protection
e. The role of employees in fall protection plans
f. All standards contained in 29 CFR Part 1926 Subpart M.

The competent person, as defined by OSHA, is an individual who, by way of training and/or experience, is knowledgeable of applicable standards, is capable of identifying workplace hazards relating to the specific operation, is designated by the contracting manager, and has authority to take appropriate actions. The competent person shall be listed on the applicable Site Specific Health and Safety Plan (HASP). See Chapter 17 of the Glenn Safety Manual for HASP requirements.

34.4.6 Employer

It is the responsibility of the employer to determine if the walking/working surfaces on which its employees are to work have the strength and structural integrity to support employees safely. Employees are permitted to work on those surfaces only when the surfaces have the necessary strength and structural integrity. The employer shall select fall protection measures compatible with the type of work being performed and specific to the site of the work. The employer shall assign a competent person that meets the requirements in Section 34.4.5 of this Chapter.

34.5 GENERAL FALL PROTECTION REQUIREMENTS

34.5.1 Rule Where Fall Protection Is Required

Anytime a worker is on a walking/working surface or constructing a leading edge with an unprotected side or edge which is 6 feet (1.8 meters) or more above a lower level, or when workers could fall into or onto dangerous equipment from 6 feet (1.8 meters) or less, the worker must be protected from falling by using guardrail systems, safety net systems, or a personal fall arrest systems.

34.5.2 Exception to the Rule

If the employer can demonstrate that it is not feasible or creates a greater hazard to use these systems, the employer shall develop and implement a fall protection plan. The fall protection plan shall be prepared by a competent person, shall be specific to the site, and shall be maintained up to date. See section 34.15 of this chapter. The fall protection plan shall be reviewed by the GSO (consult Appendix E in subpart M of 29 CFR 1926).

34.5.3 Where Protection Is Needed

Below is a list of possible exposures that require fall protection system(s) It is the responsibility of the employer to determine the fall protection required as it pertains to the work to be accomplished and the specific work site. (List may not be all inclusive):

a. **Unprotected sides and edges.** Each employee on a walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet (1.8 m) or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems.
b. **Leading edges.** Each employee who is constructing a leading edge 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems, safety net systems, or personal fall arrest systems. Exception: When the employer can demonstrate that it is infeasible or creates a greater hazard to use these systems, the employer shall develop and implement a fall protection plan. (See section 34.15)
c. **Hoist areas.** Each employee in a hoist area shall be protected from falling 6 feet (1.8 m) or more to lower levels by guardrail systems or personal fall arrest systems. If guardrail systems, [or chain, gate, or guardrail] or portions thereof, are removed to facilitate the hoisting operation (e.g., during landing of materials), and an employee must lean through the access opening or out over the edge of the access opening, that employee shall be protected from fall hazards by a personal fall arrest system.
d. **Holes.** Each employee on walking/working surfaces shall be protected from falling through holes (including skylights) more than 6 feet (1.8 m) above lower levels, by personal fall arrest systems, covers, or guardrail systems erected around such holes.

e. **Formwork and reinforcing steel.** Each employee on the face of formwork or reinforcing steel shall be protected from falling 6 feet (1.8 m) or more to lower levels by personal fall arrest systems, safety net systems, or positioning device systems.
f. **Ramps, runways and other walkways.** Each employee on ramps, runways, and other walkways shall be protected from falling 6 feet (1.8 m) or more to lower levels by guardrail systems.
g. **Excavations.** Each employee at the edge of an excavation 6 feet (1.8 m) or more in depth shall be protected from falling by guardrail systems, fences, barricades or covers. Where walkways are provided to permit employees to cross over excavations, guardrails are required on the walkway if the fall would be 6 feet (1.8 meters) or more to the lower level.
h. **Pit, well, or shaft.** Each employee at the edge of a well, pit, shaft, and similar excavation 6 feet (1.8 m) or more in depth shall be protected from falling by guardrail systems, fences, barricades, or covers.
i. **Dangerous equipment less than 6 feet.** Each employee less than 6 feet (1.8 m) above dangerous equipment shall be protected from falling into or onto the dangerous equipment by guardrail systems or by equipment guards.
j. **Dangerous equipment more than 6 feet.** Each employee 6 feet (1.8 m) or more above dangerous equipment shall be protected from fall hazards by guardrail systems, personal fall arrest systems, or safety net systems.
k. **Overhand bricklaying and related work.** Each employee performing overhand bricklaying and related work 6 feet (1.8 m) or more above lower levels, shall be protected from falling by guardrail systems, safety net systems, personal fall arrest systems, or shall work in a controlled access zone. Each employee reaching more than 10 inches (25 cm) below the level of the walking/working surface on which they are working shall be protected from falling by a guardrail system, safety net system, or personal fall arrest system. Note: Bricklaying operations performed on scaffolds are regulated by Subpart L of 29 CFR 1926.
l. **Roofing work on low-slope roofs.** Each employee engaged in roofing activities on low-slope roofs, with unprotected sides and edges 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems, safety net systems, personal fall arrest systems, or a combination of warning line system and guardrail system, warning line system and safety net system, or warning line system and personal fall arrest system, or warning line system and safety monitoring system. Or, on roofs 50-feet (15.25 m) or less in width (see Appendix A to subpart M of 29 CFR 1926), the use of a safety monitoring system alone is permitted.
m. **Steep roofs.** Each employee on a steep roof with unprotected sides and edges 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems with toeboards, safety net systems, or personal fall arrest systems.
n. **Precast concrete erection.** Each employee engaged in the erection of precast concrete members (including, but not limited to the erection of wall panels, columns, beams, and floor and roof “tees”) and related operations such as grouting of precast concrete members, who is 6 feet (1.8 m) or more above lower

levels shall be protected from falling by guardrail systems, safety net systems, or personal fall arrest systems, unless another provision provides for an alternative fall protection measure. Exception: When the employer can demonstrate that it is infeasible or creates a greater hazard to use these systems, the employer shall develop and implement a fall protection plan (See section34.15)

o. **Wall openings.** Each employee working on, at, above, or near wall openings (including those with chutes attached) where the outside bottom edge of the wall opening is 6 feet (1.8 m) or more above lower levels and the inside bottom edge of the wall opening is less than 39 inches (1.0 m) above the walking/working surface, shall be protected from falling by the use of a guardrail system, a safety net system, or a personal fall arrest system.
p. **Walking/working surfaces not otherwise addressed.** Each employee on a walking/working surface 6 feet (1.8 m) or more above lower levels shall be protected from falling by a guardrail system, safety net system, or personal fall arrest system.

34.6 FALL PROTECTION SYSTEMS CRITERIA AND PRACTICES

a. The fall protection system, selected by the employer, is to be one which the employer deems is most appropriate for protecting the worker.
b. Employers are to provide and install all fall protection systems before an employee begins the work that necessitates the fall protection.

34.7 GUARDRAIL SYSTEMS

Guardrail systems means a barrier erected to prevent employees from falling to lower levels. Guardrail system components are to be selected and constructed in accordance with the Appendix B to Subpart M, 29 CFR 1926. Guardrails constructed in accordance with Subpart M, 29 CFR 1926.502(b) will meet the requirement.

34.7.1 Specifications for Guards and Guardrails

a. Top edge height of top rails, or equivalent guardrail system members, shall be 42 inches (1.1 m) plus or minus 3 inches (8 cm) above the walking/working level. When conditions warrant, the height of the top edge may exceed the 45-inch height, provided the guardrail system meets all other criteria of this paragraph.
b. Midrails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members shall be installed between the top edge of the guardrail system and the walking/working surface when there is no wall or parapet wall at least 21 inches (53 cm) high.
c. Guardrail systems shall be capable of withstanding, without failure, a force of at least 200 pounds (890 N) applied within 2 inches (5.1 cm) of the top edge, in any outward or downward direction, at any point along the top edge.
d. Guardrail systems shall prevent punctures, lacerations or snagged clothing.

e. Steel banding and plastic banding shall not be used as top rails or midrails.
f. When guardrail systems are used at holes, they shall be erected on all unprotected sides or edges of the hole.
g. Guardrail systems used on ramps and runways shall be erected along each unprotected side or edge.

34.7.2 Temporary Removal of Guardrails

a. If a guardrail must be removed to accommodate work,
    1. only that portion of the guardrail necessary to allow the work to be done may be removed, and
    2. workers exposed to a fall hazard must be protected by another fall protection system when the guardrail is absent.

b. The guardrail must be replaced
    1. when the unguarded area is left unattended, and
    2. after the work is completed if the circumstances still require guardrails.

34.8 SAFETY NET SYSTEMS

a. Safety nets must meet the requirements of 29 CFR Part 1926.502 (c) Safety and Health Regulations for Construction Subpart M or other standard, appropriate to the type of net involved which is acceptable to the GSO.
b. Safety nets and their installations shall be capable of absorbing an impact force equal to that produced by the drop test specified the requirements of 29 CFR Part 1926.502 (c)

34.9 PERSONAL FALL ARREST SYSTEMS

a. Personal fall arrest systems must meet the requirements of 29 CFR Part 1926.502 (d)
b. Connectors, devices used to couple parts of the personal fall-arrest system and positioning device system together, shall be drop-forged, pressed or formed steel, corrosion-resistant, and smooth-surfaced to prevent damage to interfacing parts.
c. Dee-rings and snaphooks should have a minimum tensile strength of 5,000 pounds and shall be proof-tested to a minimum tensile load of 3,600 pounds without cracking, breaking, or taking permanent deformation.
d. Connecting non-locking snaphooks to an incompatibly shaped object, where roll out or unintentional disengagement could occur, or to horizontal lifelines is prohibited.
e. Design, install and use horizontal lifelines under the supervision of a qualified person, as part of a complete personal fall-arrest system that maintains a safety factor of two.
f. Employees shall have their own vertical lifeline with a breaking strength of at least 5,000 pounds.

g. Two employees may be attached to the same lifeline during elevator construction if they meet the requirements of 29 CFR 1926.502(d)(10)(ii).
h. Lifeline must be protected from being cut or abraded.
i. Self-retracting lifelines that do not limit the free-fall distance to two feet, and rip stitch, tearing and deforming lanyards, shall have a minimum tensile load of 5,000 pounds when the device is fully extended.
j. Self-retracting lifelines and lanyards that automatically limit the free-fall distance to two feet or less must have a minimum tensile load of 3,000 pounds.
k. Anchorage of personal fall-arrest equipment shall support 5,000 pounds per employee attached.
l. Do not anchor personal fall-arrest equipment to anything used to support or suspend platforms.
m. Anchorages used for attachment of personal fall-arrest system shall be designed, installed and used under the supervision of a qualified person.
n. The employer shall provide for prompt rescue of employees in the event of a fall or shall assure that employees are able to rescue themselves. Personal fall-arrest systems shall not be attached to guardrail systems.

34.10 POSITIONING DEVICES

a. Positioning device systems must meet the requirements of 29 CFR Part 1926.502 (e) Safety and Health Regulations for Construction Subpart M.
b. Positioning-device systems means a body harness rigged to allow an employee to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning.
c. Rig positioning devices so employees cannot free-fall more than two feet.
d. The anchorage shall be capable of supporting twice the potential impact load, or 3,000 pounds, whichever is greater.
e. Connectors shall follow the same criteria as outlined in section 34.9 Personal Fall Arrest Systems.

34.11 WARNING LINE SYSTEMS

a. Warning line systems must meet the requirements of 29 CFR Part 1926.502 (f)
b. Place the warning line on all sides of the roof work area, and erect it not less than six feet from the edge.
c. Warning line should consist of ropes, wires, or chains with supporting stanchions.
d. Flag, the rope, wire, or chain at six-foot intervals with high-visibility materials.
e. Stanchions shall be capable of resisting, without tipping over, a force of at least 16 pounds applied horizontally against the stanchion.
f. Stanchions shall be 30 inches above the walking/working surface.
g. Stanchions shall be perpendicular to the warning line, and in the direction of the edge.
h. The rope, wire or chain shall have a minimum of tensile strength of 500 pounds, and be capable of supporting the loads applied to the stanchions.

i. Employees are prohibited from the area between the warning line and the roof edge unless they are performing roof work in that area.
j. Equipment on roofs shall be used or stored only in areas where employees are protected by a warning line system, guardrail systems, or personal fall arrest systems.

34.12 CONTROLLED ACCESS ZONES

a. Controlled access zones (CAZ) must meet the requirements of CFR Part 1926.502 (g) Safety and Health Regulations for Construction Subpart M.\
b. A CAZ may be used in overhead bricklaying, leading edge and pre-cast concrete erection operations.

34.13 SAFETY MONITORING SYSTEMS

a. Safety monitoring systems must meet the requirements of 29 CFR Part 1926.502 (h)
b. The safety monitors shall not have responsibilities that take their attention from the monitoring function.
c. Only employees performing low-slope roofing work or employees covered by a fall protection plan shall be in areas guarded by a safety monitor system. [See 1926.501(b) (9) and 1926.502(k)]

34.14 COVERS

a. Covers must meet the requirements of 29 CFR Part 1926.502 (i) Safety and Health Regulations for Construction Subpart M.
b. Covers are a method of protection for holes.
c. Covers in roadways shall support at least twice the maximum axle load of the largest vehicle crossing the hole.
d. Covers shall carry at least twice the weight of employees, equipment and materials that may be imposed on them.
e. Secure the cover to prevent displacement by wind, equipment, or employees.
f. All covers shall be color coded or they shall be marked with the word "HOLE" or “COVER" to provide warning of the hazard. Note: This provision does not apply to cast iron manhole covers or steel grates used on streets or roadways.

34.15 FALL PROTECTION PLAN

a. Fall protection plan must meet the requirements of 29 CFR Part 1926.502 (k) Safety and Health Regulations for Construction Subpart M.
b. (2) This option is available only to employees engaged in leading edge work, and precast concrete erection work. (See 1926.501(b)(2), and (b)(12).

c. (3) To use this option, the employer must demonstrate that it is infeasible or creates a greater hazard to use conventional fall-protection equipment.
d. (4) The fall protection plan shall:
    1. Be prepared by a competent person;
    2. Be specific to the site;
    3. Be approved by GSO
    4. Be maintained up to date
    5. Be resubmitted to GSO for approval if any changes are made to the plan.
    6. Be maintained at the jobsite:
    7. Be implemented under the constant supervision of a competent person;
    8. Document why the use of conventional fall protection systems (guardrail systems, personal fall arrest systems, or safety nets systems) is infeasible or why their use would create a greater hazard.
    9. Provide a written discussion of measures to reduce or eliminate fall hazards;
    10. Identify each location where conventional fall protection methods cannot be used. These locations shall then be classified as controlled access zones and the employer must comply with the criteria in 29 CFR Part 1926.502 (g) Safety and Health Regulations for Construction Subpart M.
    11. Provide the name or other method of identification for each employee who is designated to work in controlled access zones. No other employees may enter controlled access zones.
    12. Where no other alternative measure has been implemented, the employer shall implement a safety monitoring system in conformance with 29 CFR Part 1926.502(h).
    13. In the event an employee falls, or any related mishap occurs, the employer shall provide a method to investigate the circumstances of the fall or mishap to determine if the fall protection plan needs to be changed (e.g. new practices, procedures, or training) and shall implement those changes to prevent similar types of falls or incidents.

34.16 PROTECTION FROM FALLING OBJECTS

When employees are working in areas where there is a possible danger of injury from impact, or from falling or flying objects, the employer shall provide protective helmets to the employees and shall implement one of the following measures:

a. Erect toeboards.

    Toeboards shall be erected along the edge of the overhead walking/working surface for a distance sufficient to protect workers below, capable of withstanding, without failure, a force of at least 50 pounds applied at any point along the toeboard, a minimum of 3 ½ inches (9 cm) in vertical height from their top edge to the level of the walking/working surface and not more than ¼ inch (0.6 cm) clearance above the walking/working surface and shall be solid or have openings not over 1 inch (2.5 cm) in greatest dimension. Where tools, equipment,

or materials are piled higher than the top edge of a toeboard, paneling or screening shall be erected from the walking/working surface or toeboard to the top of a guardrail system's top rail or midrail, for a distance sufficient to protect employees below.

b. Canopy structure.

Canopies, when used as falling object protection, shall be strong enough to prevent collapse and to prevent penetration by any objects which may fall onto the canopy.

c. Guardrail systems

Guardrail systems, when used as falling object protection, shall have all openings small enough to prevent passage of potential falling objects.

d. Roof Work

Materials and equipment shall not be stored within 6 feet (1.8 m) of a roof edge unless guardrails are erected at the edge. Materials which are piled, grouped, or stacked near a roof edge shall be stable and self-supporting.

e. Overhand bricklaying and related work:

No materials or equipment except masonry and mortar shall be stored within 4 feet (1.2 m) of the working edge. Excess mortar, broken or scattered masonry units, and all other materials and debris shall be kept clear from the work area by removal at regular intervals.

34.17 TRAINING REQUIREMENTS

The following training provisions supplement and clarify the requirements of CFR 1926.21 regarding the hazards addressed in 29 CFR 1926 Subpart M.

Employers are required to provide a training program for each employee who might be exposed to fall hazards. The program must enable each worker to recognize the hazards of falling, and be trained in the procedures to be followed in order to minimize these hazards. The employer must prepare and provide at the workplace a written certification record. The written certification record is to contain the name or other identity of the employee trained, the date(s) of the training, and the signature of the person who conducted the training, or the signature of the employer. If the employer relies on training conducted by another employer, the certification record shall indicate date the employer determined the prior training was adequate rather than the date of actual training. The latest training certification shall be maintained and be made available to the GSO upon request. All training records should be up to date.

Each employee must be trained, as necessary, by a competent person qualified in the following areas:

a. The nature of the fall hazard.
b. The correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection systems to be used.
c. The use and operation of guardrail systems, personal fall arrest systems, safety net systems, warning line systems, safety monitoring systems, controlled access zones, and other protection systems to be used.
d. The role of each employee in the safety monitoring system when this system is used.
e. The limitations on the use of mechanical equipment during the performance of roofing work on low-sloped roofs.
f. The correct procedures for handling and storage of equipment and materials, and the erection of overhead protection.
g. The role of employees in fall protection plans.
h. Knowledge of applicable Federal, State, and local requirements and standards.

34.17.1 Retraining

a. Employees may receive more training when it is believed that previously trained employees do not understand nor have skills needed to recognize and minimize these hazards.
b. Retraining is required when changes in the workplace, or changes in the fall protection equipment render previous training obsolete.

34.18 GUIDELINES FOR SCAFFOLDING

NOTE:

The use of all scaffolding must comply with OSHA CFR 1926 Subpart L, and CFR 1910.28. Erection and dismantling of scaffolding must be done under the direct supervision of a competent person.

Training Requirements

The employer shall have each employee who performs work while on a scaffold trained by a person qualified in the subject matter to recognize the hazards associated with the type of scaffold being used and to understand the procedures to control or minimize those hazards.

Erection of Scaffolding

Prior to Erection-All Scaffold Assemblies

a. Jobsite should be inspected to determine ground conditions, and for proximity of electric power lines, overhead obstructions, wind conditions, the need for overhead protection or weather protection coverings. These conditions must be evaluated and adequately provided for.
b. Frame spacing and mud sill size can only be determined after the total loads to be imposed on the scaffold and the strength of the supporting soil or structure are calculated and considered. This analysis must be done by a qualified person.
c. Stationary scaffolds over 125 feet in height and rolling scaffolds over 60 feet in height must be designed by a professional engineer.
d. All equipment must be inspected to see that it is in good condition and is serviceable. Damaged or deteriorated equipment should not be used.
e. Wood planks should be inspected to see that it is graded for scaffold use, is sound and in good condition, straight grained, free from saw cuts, splits and holes. (Not all species and grades of lumber can be used as scaffold plank. Wood planks used for scaffolding must be specifically graded for scaffold use by an approved grading agency).

Erection of Fixed Scaffold

NOTE:

CFR 29 1926.451(g)(2) of CFR 29 1926.451 addresses fall protection for scaffold erectors and dismantlers.

a. Scaffolding must be erected, moved, or disassembled only under the supervision of qualified persons. Hard hats must be worn by all persons erecting, moving, dismantling or using scaffolding.
b. Mud sills must be adequate size to distribute the loads on the scaffolding to the soil or supporting structure. Sills should be level and in full contact with the supporting surface.
c. Base plates or screwjacks with base plates must be in firm contact with both the sills and the legs of the scaffolding. Compensate for uneven ground with screwjacks with base plates. Unstable objects such as blocks, loose bricks, etc. Shall not be used.
d. Plumb and level scaffolding until connections can be made with ease. Be sure scaffold stays level and plumb as erection progresses.
e. The following general guides are minimum requirements when utilizing ties, guys, bracing and/or outriggers for a safe stable scaffolding assembly:
    - Scaffolding must always be secure when the height of the scaffold exceeds for (4) times the minimum base width.
    - The bottom tie must be placed no higher than four (4) times the minimum base width and every 26 feet vertically thereafter. Ties should be placed as close to the top of the scaffold as possible and, in no case, less than four (4) times the minimum base width of the scaffold from the top.

- Vertical ties should be placed at the ends of scaffold runs and at no more than 30 feet horizontal intervals in between.
- Ties should be installed as the erection progresses and not removed until the scaffold is dismantled to that height.
- Side brackets, cantilevered platforms, pulleys or hoist arms and wind conditions introduce overturning and uplift forces that must be considered and compensated for. These assemblies may require additional bracing, tieing or guying.

f. Work platforms must be fully planked either with scaffold graded solid sawn or laminated plank, in good sound condition, or with fabricated platforms in good condition.
g. Each plank must overlap the support by a minimum of 6 inches or be cleated, i.e. 8 foot planks on 7 foot spans must be cleated.
h. Plank should not extend beyond the support by more than 18 inches. Such overhangs should be separated from the work platform by guard-railing so that they cannot be walked on.
i. Plank on continuous runs must extend over the supports and overlap each other by at least 12 inches.
j. Spans of full thickness, 2 inch by 10 inch scaffold grade planks, should never exceed 10 feet. Loads on plank should be evenly distributed and not exceed the allowable loads for the type of plank being used. No more than one person should stand on an individual plank at one time.
k. Planks and/or platforms should be secured to scaffolding when necessary to prevent uplift of displacement because of high winds or other job conditions. \Guardrails must be used on all open sides and ends of scaffold platforms. Both top and midrails are required.
l. Toeboards are required whenever people are required to work or pass under or around the scaffold platform.
m. Acess must be provided to all work platforms. If it is not available from the structure, access ladders, frames with built-in ladders, or stairways must be provided. When frames with built-in ladders are used, cleated plank or fabricated plank must be used at platform levels to minimize or eliminate platform overhang. Access ladders must extend at least three (3) feet above platforms.
n. Side and end brackets are designed to support people only. Materials should never be placed on cantilevered platforms unless the assembly has been designed to support material loads by a qualified person. (These types of platforms cause overturning and uplift forces which must be compensated for. All frames should be fastened together to prevent uplift an overturning moment compensated for with counterweights or adequate ties).
o. Putlogs must never be used for the storage of materials. They are designed for personnel use only. Special care should be taken when putlogs are used.
p. Scaffold should not be used as material hoist towers or for mounting derricks unless the assembly is designed by a qualified person.
q. Check the erected assembly before use. A qualified person should thoroughly inspect the completed assembly to see that is complies with all safety codes, that nuts and bolts are tightened, that it is level and plumb, that work platforms are fully planked, that guardrails are in place and safe access is provided.

Erection of Rolling Scaffolds

a. Height of the tower must not exceed four (4) times the minimum base dimension. Outrigger frames or outrigger units on both sides of the tower may be used to increase base width dimension when necessary.
b. All casters must be secured to frame legs or screwjacks with a nut and bolt or other secure means. Total weight of tower should not exceed the capacity of the casters.
c. Screwjacks must not be extended more than 12 inches above caster base. Tower must be kept level and plumb at all times.
d. Horizontal/diagonal bracing must be used at the bottom and top of tower and at intermediate levels of 20 feet. Fabricated planks with hooks may replace the top diagonal brace.
e. All frames must be fully cross-braced.
f. Only prefabricated plank(s) or cleated plank(s) should be used.
g. Casters must be locked at all times the scaffold is not being moved.

Use of Scaffolds

All Scaffolds

NOTE:

Each employee on a scaffold more than 10 feet (3.1 m) above a lower level shall be protected from falling to that lower level. (See CFR 29 1926.451 Paragraphs (g)(1)(i) through (vii) establish the types of fall protection to be provided to the employees on each type of scaffold.)

a. Inspect the scaffold assembly before each use to see that it is assembled correctly, that it is level and plumb, base plates are in firm contact with sills, bracing is in place and connected, platforms are fully planked, guardrails in place, safe access is provided, that it is properly tied and/or guyed and that there are no overhead obstructions or electric lines within 12 feet of the scaffold assembly.
b. Use only the safe means of access that is provided. Do not climb bracing or frames not specifically designed for climbing. If such access is not provided, insist that it be provided.
c. Climb safely, face the rungs as you climb up or down, use both hands, do not try to carry materials while you climb.
d. Do not work on slippery rungs to avoid slipping.
e. Do not overload platforms with materials.
f. Working heights shall not be extended by planking guardrails or by use of boxes or ladders on scaffold platforms.
g. Do not remove any component of a completed scaffold assembly except under the supervision of a qualified person. Any component that has been removed should be immediately replaced.

Rolling Towers All of the above precautions plus:

a. Do not ride manually propelled rolling scaffold. No personnel should be on the tower while it is being moved.
b. Lock all casters before getting on the tower.
c. Work only within the platform area: do not try to extend overhead work area by reaching out over guardrailing.
d. Do not bridge between two rolling towers with plank or stages.
e. Secure all materials before moving scaffolds.
f. Be sure floor surface is clear of obstructions or holes before moving scaffold.
g. Be sure there are no overhead obstructions or electric power lines in the path of rolling scaffold.
h. Rolling towers must only be used on level surfaces.
i. Move rolling towers by pushing at the base level only. Do not pull from the top.

34.19 GUIDELINES FOR AERIAL LIFTING EQUIPMENT

Types of Aerial Lifting Equipment: Scissor Lift and Boom Lift.

Supervisors are to assure the operation of any personnel lifting equipment is restricted to those who have gone through training, including the pre-use inspection, inspecting the worksite, traveling with the equipment, completing the work, parking, and all applicable manufacturers operational procedures.

All Aerial Lifting Equipment:

a. Personnel shall not enter or leave the platform when it is elevated!
b. Select the most appropriate Aerial Lifting Equipment for the specific location, including height and reach.
c. Personnel shall remain substantially within the confines of the work platform!!
d. Personnel shall stand on the floor of the Aerial Lifting Equipment only, not on the handrails or items such as ladders, scaffolding or boxes, either placed on the platform floor or handrails!!!

Scissor Lift

Personal Fall Protection shall be worn with a lanyard attached to a lanyard anchorage point when working from scissor lifts.

Characteristics of a Scissor Lift:

a. The controls are up on the platform.
b. Large working platform.
c. Electrically or propane powered.

d. For use in working around “not” over equipment.
e. Safety rail around lifting platform.
f. Scissor Lift action.
g. Kick plate on floor of platform.

Recommended Scissor Lift Safety Checklist:

a. Always check job site for unsafe working conditions.
b. Inspect machine before using. Including: pinch points, pins at swivel points, hydraulic hoses, cylinders for scoring & leaks. Do not use machine if it is malfunctioning in any way.
c. DO NOT override any hydraulic, mechanical, or electrical safety devices.
d. Make sure platform rail holding bolts are secured.
e. Always distribute load evenly over platform floor area.
f. A scissor lift is only safe on a level surface. Be sure surface is flat and level.
g. Never extend scissor lift with railings folded down.
h. Electrocution is always a danger. Be aware of high voltage wires in the area where you are working.
i. Never move a scissor lift in the raised position. Lower first, then after checking for a level surface and overhead obstructions, raise lift.
j. DO NOT lean over any platform guard rails to perform work.
k. **DO NOT** use ladders or scaffolding on the platform to obtain greater height.
l. **DO NOT** drive on uneven, sloping or soft terrain, as this is hazardous and must be avoided.
m. Hard Hats shall be worn by all personnel in the work platform.
n. Do not use machine if your physical or mental condition is uncertain in any way.
o. When machine is not in use, disable controls to prevent unauthorized use.

Boom Lifts

All personnel in the platform of boom lifts shall wear fall protection devices at all times.

Characteristics of a Boom Lift:

a. Used in areas where space is limited (especially for working over machinery or approaching overhead wires).
b. Works on a hydraulic telescopic reach principle.
c. The operator operates the controls from the bucket or cage.
d. May have outrigger legs to add stability.
e. May be electrically or propane powered.

Recommended Boom Lift Safety Checklist:

a. Visually inspect Boom Lift before it is used. Report any defects to supervisor. Do not use equipment if it is defective.
b. Check for overhead obstructions and electrical lines.

c. Insure that load on the Boom Lift is within the manufacturers rated capacity.
d. Insure that outriggers and stabilizers are used, if the manufacturer’s instruction so requires.
e. Insure that all gates to work platform are closed.
f. The operator and passenger(s) shall wear a harness and be connected to the Boom Lift with a lanyard at the work platform position.
g. Railings, ladders or any other device in or on the work platform shall not be used to achieve additional working height or reach.
h. Any loading which includes a horizontal load shall be avoided unless the Boom Lift is designed for that application.
i. The operator shall observe whether there are any defects in the equipment during all operations, and stop and correct them as necessary.
j. Secure tools and equipment.

34.20 BIBLIOGRAPHY

- Title 29 Code of Federal Regulations Part 1926 Safety and Health Regulations for Construction, Subpart M.
- Construction Basic Safety Manual Ohio Division of Safety & Hygiene Bureau of Workers Compensation.

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